

## CLAIMS

I claim:

1. A polymer based micro-machine formed by the steps comprising:
  - a. forming a mold of a design through a lithography process;
  - 5 b. transferring said design to a polymer substrate through a hot embossing process;
  - c. depositing a metal layer over at least part of said design; and
  - d. connecting at least one electrical lead to said metal layer.
2. The polymer based micro-machine according to claim 1, wherein said design is a structure for a tunneling current sensor.
- 10 3. The polymer based micro-machine according to claim 1, further including the step of forming two separate polymer substrates and adhering said separate substrates together.
4. The polymer based micro-machine according to claim 3, further including the step of back etching at least one of said polymer substrates.
5. The polymer based micro-machine according to claim 1, wherein said step of transferring  
15 said design includes using PMMA as the polymer substrate.
6. The polymer based micro-machine according to claim 1, wherein said metal layer is deposited over substantially all of a surface containing said design and is etched to conform to said design.
7. The polymer based micro-machine according to claim 2, wherein said design structure is  
20 a comb drive.
8. The polymer based micro-machine according to claim 1, wherein two molds are formed with each of said molds forming a separate polymer substrate.

9. The polymer based micro-machine according to claim 8, wherein said separate polymer substrates are metalized and bonded together.
10. A polymer based micro-machine comprising:
- a. a polymer substrate having a polymer micro-structure formed thereon;
  - 5 b. a metal layer over at least part of said micro-structure; and
  - c. at least one electrical lead connected to said metal layer.
11. The polymer based micro-machine according to claim 10, wherein said micro-structure is a structure for a tunneling current sensor.
12. The polymer based micro-machine according to claim 10, wherein said substrate and  
10 micro-structure are formed of PMMA.
13. The polymer based micro-machine according to claim 11, wherein micro-structure is a comb-drive.
14. The polymer based micro-machine according to claim 10, wherein said micro-structure further comprises two polymer sections having metal formed thereon and said two polymer  
15 sections being bonded together.
15. A reduced noise tunneling sensor comprising:
- a. a first proof mass influencing a first tunneling tip;
  - b. a second proof mass having substantially the same mass as said first proof mass;
  - c. said second proof mass influencing a second tunneling tip;
  - 20 d. a indifference circuit receiving a first signal related to movement of said first proof mass and a second signal related to movement of said second proof mass; and

e. wherein said first and second signals have a useful signal component and a noise component and said indifference circuit subtracts said first and second signals, thereby doubling said useful signal component and eliminating said noise component.

16. The reduced noise tunneling sensor of claim 15, wherein a base structure of said tunneling  
5 sensor is formed of a polymer material.

17. The polymer based micro-machine according to claim 15, wherein said substrate and micro-structure are formed of PMMA.

18. The polymer based micro-machine according to claim 15, wherein micro-structure is a comb-drive.